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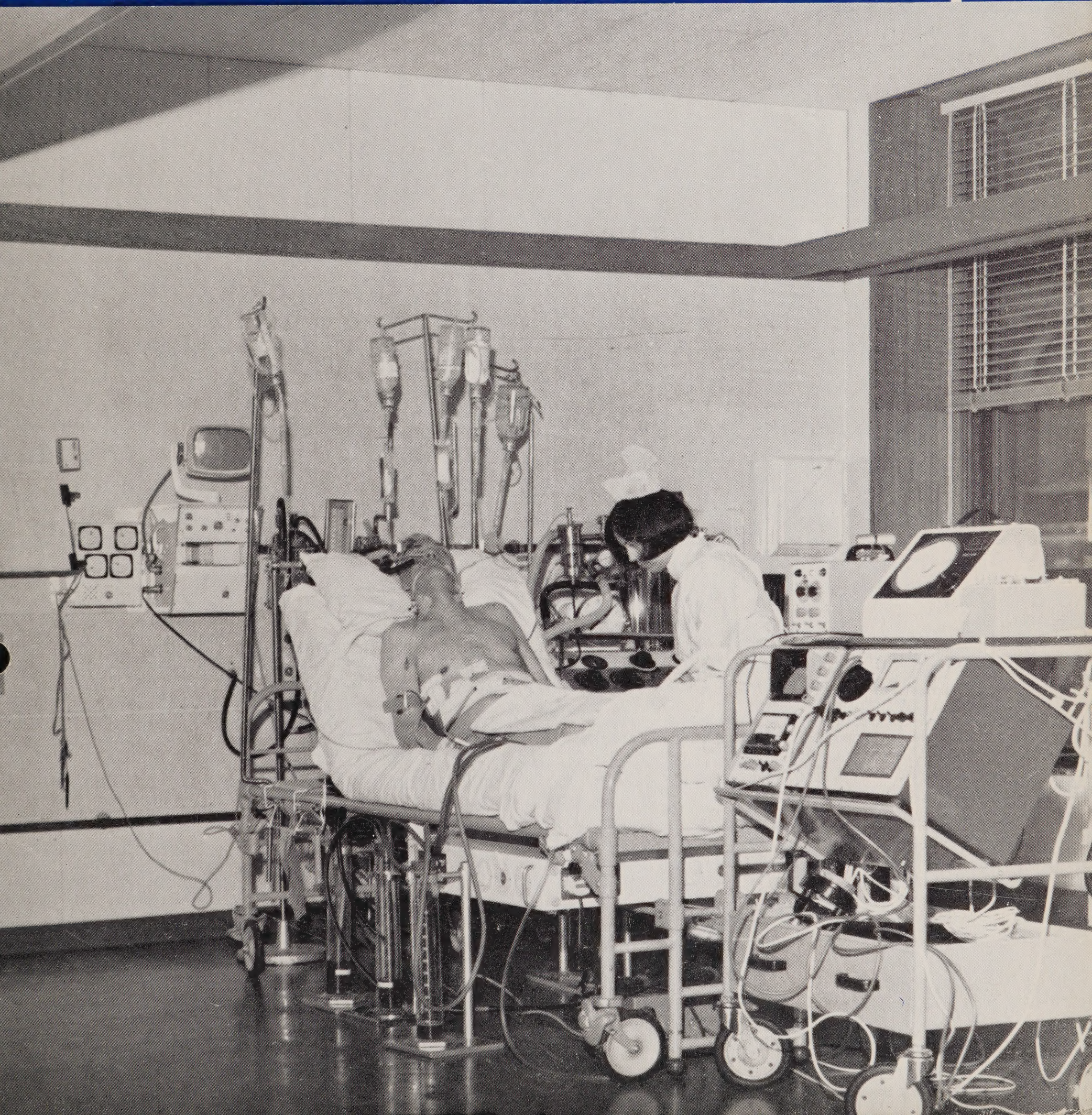
HOSPITAL BUILDING NOTE

27

INTENSIVE THERAPY UNIT



Department of Health and Social Security
London

Welsh Office
Cardiff

Hospital Building Note
Number 27

Intensive Therapy Unit

Contents

I Scope

II General considerations

III List of rooms

IV Description of rooms

V Engineering services

Appendix I—Table of room areas

Building Notes recommend the standards of accommodation and services for hospital departments which the Department of Health and Social Security consider it reasonable to provide. Each Building Note contains a Cost Note from which may be derived a Departmental Cost Allowance appropriate to the department. Hospital Boards are at liberty to depart from the design recommendations given in Building Notes provided that they are satisfied that the standards of accommodation and services they adopt are adequate. The Departmental Cost Allowance, however, is to be regarded as the maximum sum of money available for the department and it should not be exceeded. Hospital Boards are encouraged to produce designs for the provision of appropriate accommodation and services at a cost less than the Departmental Cost Allowance.

An addendum to Appendix E of Hospital Building Note No. 2, *The Cost of Hospital Buildings*, which sets out cost recommendations for the Intensive Therapy Unit, is supplied with this Building Note.

I. Scope

1. This Building Note gives guidance on the design of the intensive therapy unit in a district general hospital. Many of its principles also apply to teaching hospitals, but as the purpose of an intensive therapy unit in these hospitals is also to facilitate research and specialised work, some of the items listed under "General considerations" and some of the design consequences may differ.

II. General considerations

Purpose of unit

2. The intensive therapy unit is a place where critically ill patients can be brought together and given constant and undivided attention by medical and nursing staff using highly specialised equipment.

*The provision of such a unit can be justified on three counts:

(i) better provision can be made for critically ill patients who need the constant and undivided attention of skilled nurses, frequent attention from doctors and the use of special equipment;

(ii) better provision can be made for patients remaining in the general wards, for attention is not diverted from them by the needs of the critically ill;

(iii) the best use can be made of resources of trained nurses, both day and night.

3. *It is recommended that the intensive therapy unit should be reserved for patients in a critical stage of illness. Its advantages tend to be lost if patients who do not need continuous nursing are admitted simply because they are severely ill. Examples of the type of case envisaged are:

(*a*) patients who have suffered multiple injuries, particularly involving the head, or who have had major operations and are in need of continuous observation with frequent pulse or blood pressure recording for control of bleeding;

(*b*) patients who require maintenance of an adequate air-way;

(*c*) patients whose cardio-vascular integrity needs to be maintained;

(*d*) patients who require control of a toxaemia of metabolic or infective origin;

(*e*) patients who require relief from or prevention of severe shock from whatever cause.

4. Patients selected for treatment in an intensive therapy unit have common needs irrespective of specialty, age or sex. Special provision must be made, however, for patients who require isolation on account of infection or other reason. Patients should leave the unit as soon as they no longer need the special facilities it offers.

5. The acute bed complement will normally include those beds allocated for intensive therapy. Where the needs of the patient require it a bed in the general ward should be kept available for him when he is ready to leave the unit.

Size of unit

6. It is important that the load likely to be placed on an intensive therapy unit should be assessed before the unit is planned. In planning new hospitals it may be necessary to rely on the experience of existing hospitals in the area. The advantage lies heavily with a prospective assessment, ideally over the period of a year, in order to take account of seasonal variations.

7. The number of places required will be approximately between one and two per cent of the total acute beds, excluding the beds designated for geriatric or psychiatric patients. However, where a large number of regional specialties are included at the hospital additional intensive therapy beds may be required. The average sized unit capable of serving a district general hospital will have from six to eight beds, as this size will cater for the required number of patients and is a unit capable of being supervised efficiently. Units smaller than six beds are uneconomical of staffing, accommodation, essential services and equipment.

8. All patients requiring intensive therapy should be brought together within one area of the hospital wherever possible. This may be more difficult where there are regional specialties such as cardio-thoracic surgery, neuro-surgery, burns, and facilities for acute haemodialysis (particularly in teaching hospitals), but the fullest consideration should be given to the possibility of sharing facilities.

9. Hospitals with cardiology units attracting a substantial case load of coronary infarcts may well decide to provide a coronary care unit in association with the intensive therapy unit. Otherwise such cases can be dealt with in the intensive therapy unit provided that the special requirements of patients suffering from myocardial infarction are met.

Siting

10. Ideally this unit should be sited on the same floor as the operating theatre department. There are advantages in positioning it close to that department as it allows concentration of engineering services (sharing of plant and switchgear rooms), ease of communication

*See the Annual Report of the Chief Medical Officer of the Ministry of Health for the year 1966 (XVII (b)), H.M. Stationery Office, price £1 3s. 6d. net.

and, if the unit is planned close to the post-operative recovery room, some staff and ancillary accommodation can be shared (see Figure 1).

11. The possibility of future expansion needs to be borne in mind as developments in medicine tend to increase the demand for intensive care facilities and it may, in the light of operational policies, be more convenient to site this unit adjacent to the general ward complex. Easy access between this unit, the accident and emergency department, operating theatres and wards is essential.

12. There are advantages in having natural daylight and, if possible, a pleasant view out of the windows in the bed areas, sister's room and staff lounge/beverage bay as the staff and patients should not feel psychologically cut off from the outside world while in the unit.

13. The conversion of older accommodation into an intensive therapy unit is sometimes possible. It will be found that a Nightingale ward will lend itself very well to conversion by reason of its open design.

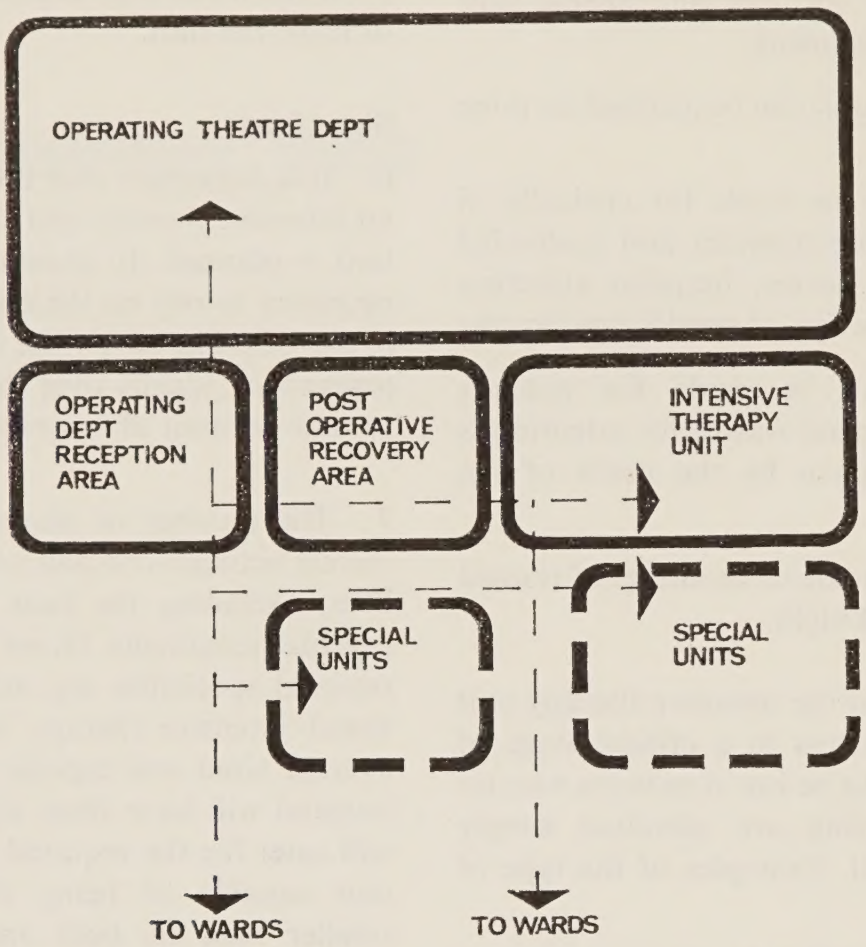


FIGURE 1. Development layout.

III. List of rooms

A. Basic accommodation

(i) Patient area
(ii) Staff base
(iii) Clean utility area
(iv) Sister's room
(v) Staff lounge/beverage bay
(vi) Equipment store
(vii) Dirty utility/sluice room
(viii) Laboratory/clinical room
(ix) Doctor's room/overnight stay
(x) Store for linen trolley(s)
(xi) Staff lavatory and cloakroom
(xii) Gowning area and entrance to unit
(xiii) Relatives' room
(xiv) Cleaners' room
(xv) Switchgear room
(xvi) Circulation space necessary for the above

B. Communications

(i) Plant room
(ii) Workshop for the repair and maintenance of equipment.

Functional unit

14. The functional unit is the intensive therapy unit for eight patients.

IV. Description of rooms

15. The essential planning feature of the unit is a fully observable bed area with adequate space to position the beds and equipment as considered necessary. The staff base should be as close to the bed area as possible (see Figures 2 and 3).

16. It is important that the planning of the supply and disposal routes is carefully considered. The movement of staff and of clean and dirty articles should be minimised.

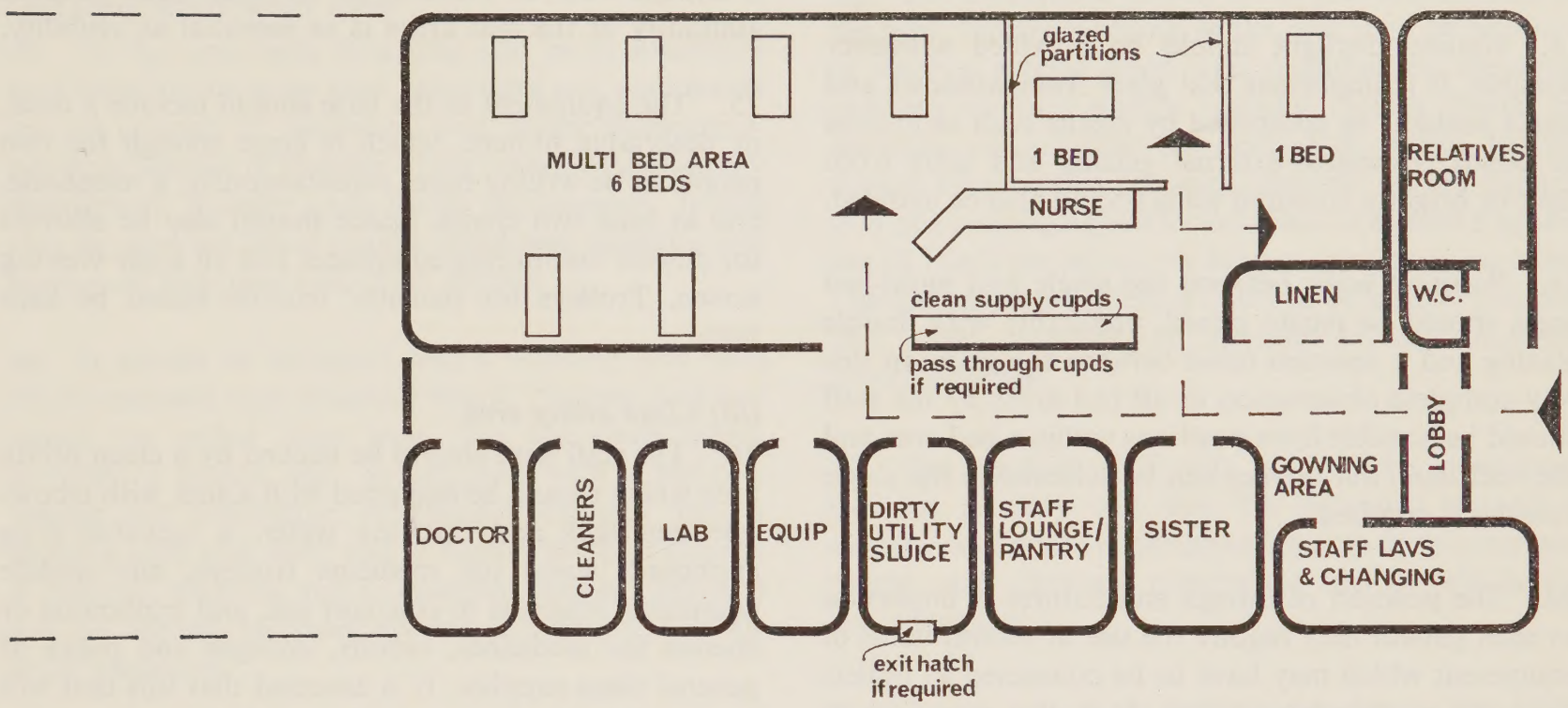


FIGURE 2. Intensive Therapy Unit.

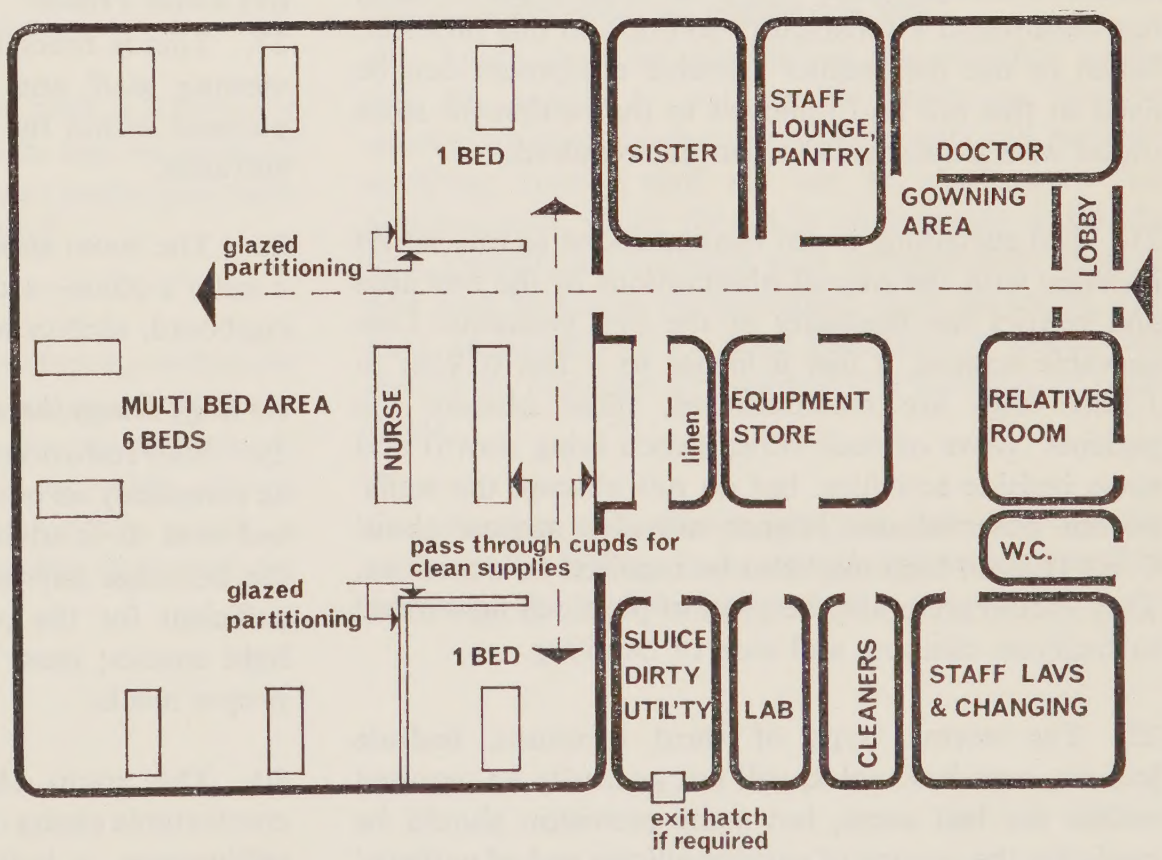


FIGURE 3. Intensive Therapy Unit.

A. Basic accommodation

(*i*) *Patient area*

17. Usually this should be arranged as one large multi-bed area and a minimum of two single rooms. The area should be planned with sufficient space and flexibility to make it possible to enclose one or more of the bed areas into single cubicles at a later date if this should be considered medically desirable. Single-bed rooms will require a minimum area of 200 square feet (18.5m^2) and should be roughly square. Beds in multi-bed areas should be positioned with at least 11 to 12 feet (3.30m to 3.60m) centre to centre.

18. Natural daylight should be provided whenever possible. It is important that glare from windows and direct sunlight be controlled by means such as louvres or blinds. Excessive external glazing and glare from light or brightly coloured walls should also be avoided.

19. Partition walls between the single and multi-bed areas should be partly glazed, preferably with double glazing and a venetian blind between the glass. In this way complete observation of all bed areas by the staff should be possible from positions within a bed area and the staff base, but privacy can be achieved in the single cubicles if required.

20. The position of fittings and fixtures is important as each patient may require the use of several items of equipment which may have to be connected to outlets from the engineering services. It is also necessary to allow for flexibility of the bed positions within the area. A fixed rail (or two at different heights) attached to the wall behind the bed heads, or, alternatively, a fixed shelf (minimum depth of 1 foot 4 inches (0.40m) to allow adequate storage space) with a rail attachment in front, has been found a satisfactory solution to this problem. When in use the smaller portable equipment can be fixed to this rail and removed to the equipment store (fitted with similar rails) when not required.

21. Bed curtaining is not recommended as this would interfere with the overall observations of the bed area and restrict the flexibility of the bed positions. Low movable screens, 3 feet 6 inches to 4 feet (0.95m to 1.20m) high are recommended, these obscure the patients' views of each other (when lying down) and some bedside activities, but do not obscure the staffs' overall observations. Higher movable screens about 6 feet (1.80m) high may also be required on occasions. They should preferably be made of plastic or light metal to facilitate cleaning and ease of handling.

22. The normal type of ward furniture, bedside lockers, over-bed tables, will not generally be required within the bed areas, but some provision should be made for the storage of surplus pillows and of patients' personal belongings such as toilet articles and spectacles; a shelf behind the bed will be convenient for these. Locker or cupboard space for patients' clothing will be required but not by the bedside. Comfortable stacking chairs should be available for staff and visitors who may be watching at the bedside, and these can be removed to the equipment store when not required.

23. A lavatory basin with elbow-operated taps should be provided in each single-bed area and at least two lavatory basins in the multi-bed area carefully sited so that the positioning of these does not interfere with the flexible positioning of the beds.

(*ii*) *Staff base*

24. The staff base should be the focal point of the unit and must be planned so that all beds can be seen: it should also be planned as an open area because audibility of the bed areas is as essential as visibility.

25. The equipment at the base should include a desk, or desk/table fitment, which is large enough for two people to be writing notes simultaneously, a telephone, and at least two chairs. Space should also be allowed for patient monitoring equipment and an x-ray viewing screen. Trolleys for patients' records would be kept here.

(*iii*) *Clean utility area*

26. The staff base should be backed by a clean utility area which should be equipped with a sink with elbow-operated taps and drinking water, a lockable drug cupboard, space for medicine trolleys, any mobile equipment which is in constant use, and cupboards or shelves for medicines, lotions, syringes and packs of general clean supplies. It is assumed that this unit will be served by the central sterile supply department, but a small, portable, electrically heated pressure steam sterilizer (to draft B.S.3970, part 4) for emergency use, may be required.

(*iv*) *Sister's room*

27. This is needed as an office to be used for interviewing staff and preparing reports. It should be planned within the unit and should be sited near the entrance.

28. The room should contain the usual equipment of a sister's office—a desk, chairs, table, lockable storage cupboard, shelves and possibly a filing cabinet.

(*v*) *Staff lounge/beverage bay*

29. Staff rest-room accommodation should be planned as compactly as possible to limit the distance from the bed area. It is advisable to plan this staff lounge with the beverage bay as the facilities required need to be sufficient for the preparation of only beverages and light snacks; most patients will be too ill to require proper meals.

30. The room should be equipped with several comfortable chairs or settees, a low coffee table, a small refrigerator, a boiling plate(s), a sink and draining board, a cupboard for storing crockery and a cupboard for storing beverage mixes and small quantities of food.

31. In some circumstances, however, two separate rooms planned adjacent to each other may be preferable.

(vi) Equipment store

32. This should be planned within the unit and should accommodate all the equipment which must be readily accessible when needed. If many of the smaller items of equipment, such as suction bottles, timers, trays, sphygmomanometers, are fitted on to rails within the bed areas, it will be necessary to provide similar type rails within the store. It would be convenient to have several electric socket outlets so that battery charging units can be installed and equipment tested before being taken into the bed areas.

(vii) Dirty utility/sluice room

33. In this unit both functions can be satisfactorily performed in the same area. Here dirty and used goods can be cleaned (if necessary) and stored temporarily pending disposal or transfer to the central sterile supply department, laundry and similar departments. It will also be used for urine testing, emptying, cleaning and storing of bed-pans and urine bottles.

34. It should be equipped with a worktop sink with elbow-operated taps, draining board, disposal bins and stands for soiled linen bags. For the sluice room activities it should also be equipped with a bed-pan washer and disinfector, or bed-pan disposal unit, a flushing sink and slab, and a heated bed-pan cabinet if required. Shelving and a ventilated storage cupboard will be needed for stool specimens and for 24-hour urine specimens.

(viii) Laboratory/clinical room

35. A small laboratory is required for simple clinical investigations. A full scale laboratory is unnecessary as most of the investigations required, such as bio-chemical and haematological investigations, should be done in the main pathology department.

36. The room should be equipped with a laboratory sink and benches, storage cupboards and engineering service outlets. A refrigerator and also some equipment for blood estimation may be required.

(ix) Doctor's room/overnight stay

37. A room should be provided, preferably within the unit, which the doctor on duty can use as an office and as a bedroom (if necessary) when on call at night. It should be equipped with a desk or table, chairs, bookcase or shelves, a twin x-ray viewing screen, a convertible settee or divan, a hanging cupboard for clothes, and a lavatory basin.

(x) Store for linen trolley(s)

38. It is now usual to provide a centralised linen supply, with each ward or unit holding only its own day-to-day working stock of linen. Storage cupboards should be provided to accommodate the linen on shelves or trolleys, with high level shelving for additional items such as pillows. One or two of these cupboards, each of about 25 square feet ($2.5m^2$) should be provided for the unit.

(xi) Staff lavatory and cloakroom

39. The cloakroom should be sited at the entrance to the unit. Nurses working in the unit may be required to wear a special gown and facilities for removing ordinary uniform and/or outdoor clothes should be available on entering the unit. Full length lockers should be provided for each member of the nursing staff and a changing and locker space of at least 8 square feet ($0.75m^2$) per person on duty at any time is required. The staff ratio to patient is likely to be high in this unit and, when planning, an estimate of staff numbers should be made.

40. The medical staff will not require cloakroom facilities as they will don the necessary protective clothing and boots in the gowning area at the entrance to the unit. Personal possessions can be left in the doctor's room.

41. A w.c., a lavatory basin and a shower should be provided in an area next to the nurses' cloakroom, with doors opening off a corridor as well as the cloakroom so that the facilities can be used by male or female staff.

(xii) Gowning area and entrance to unit

42. Space must be provided at the entrance to the unit for people to put on the protective clothing necessarily worn by doctors, visiting staff and patients' relatives; nursing staff will use the cloakroom. This gowning area, which should be immediately within the unit, should contain items such as cupboards, shelves, and coat hooks to accommodate clean garments, and bags or containers for used garments. A bench seat should be provided to facilitate the donning of over-boots.

43. As this unit should be used only by essential users and visitors, it is considered unnecessary to provide a manned reception area.

44. A lobby with double doors to allow some control of the air flow within the unit should be provided (see Figures 2, 3, 4, 5 and 6). This lobby would be adequate to accommodate the movement of people only and both sets of doors would have to be opened during the passage of beds. However, if this unit is planned with the post operative recovery unit (see Figure 4) it is important that an air-lock should be provided either at the entrance to these combined units (if it is decided to consider these areas as "clean" areas) or else between these units and the operating department (if it is decided to consider them as a separate controlled air-flow system from the operating department). Such an air-lock should be large enough to accommodate a bed while in transit, and the accompanying personnel. Approximately 200 square feet (18.5m²).

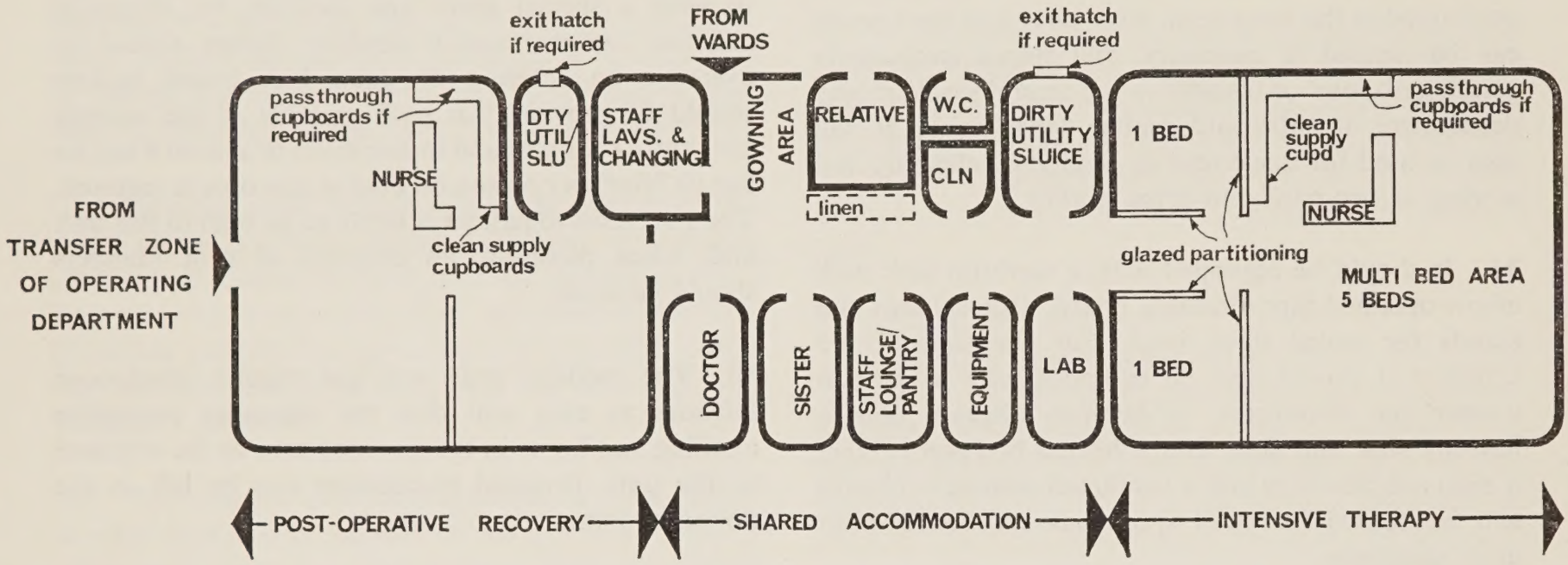


FIGURE 4. Intensive Therapy Unit.
This diagram illustrates the linking of a post-operative recovery unit with an intensive therapy unit. Some staff and ancillary rooms can be shared by both units. An air-lock would be required either at the entrance from wards or from operating theatres (see paragraph 44).

(xiii) Relatives' room

45. This room should be sited outside the unit. The room should be equipped with comfortable chairs and divans, a table and a hanging cupboard for clothes. A w.c. and lavatory basin should be provided but it may be more convenient to plan this nearby, opening off a corridor, rather than *en suite* with the room which would restrict its use exclusively to relatives.

46. When visiting patients in the unit, relatives will don protective clothing and overshoes in the gowning area which will be at the entrance to the unit.

(xiv) Cleaners' room

47. This should be sited inside the unit. It should be equipped with a bucket sink, with hot and cold water, drainer, and space for items such as mechanical cleaning equipment and cleaning utensils.

(xv) Switchgear room

48. A switchgear room to house the main isolator and distribution switch/fuse gear should be located centrally to reduce the length of circuit wiring. The recommended size is 8 feet by 5 feet (2.40m by 1.50m) deep (minimum) to allow a clear passage in front of the switchgear; the dimensions will, however, depend upon the quantity and type of equipment to be installed. The room should be kept dry and well ventilated and the door should be lockable and open outwards. Where it is practical and economic the switchgear room may be combined with the plant room, but due care should be taken to ensure that the switchgear is mounted clear of all pipes carrying liquids to prevent damage in case of leakages.

(xvi) Circulation space

49. A minimum clear width of 7 feet (2.10m) is recommended in circulation areas where nurses are manoeuvring patients' beds and trolleys.

B. Communications

(i) Plant room

50. A plant room to house the mechanical ventilation/ air conditioning plant and other central services, e.g.

medical gases, will be required. The area provided must allow adequate access for the maintenance of the plant. The room should, preferably, be located within the area of the department and so sited that it does not interfere with the normal working of the department. In a multi-storey building it may not be possible to locate the plant room within the department and provision therefore should be made to site it on the roof. The construction should be designed to keep the emission of noise and vibration to acceptable limits. Natural ventilation of the room should, normally, be satisfactory. Where it can be conveniently arranged (e.g. within a whole hospital complex) the plant room may be shared with other departments. The area suggested is 110 square feet (10m^2).

(ii) Workshop for the repair and maintenance of equipment

51. A small workshop may be required to accommodate minor repairs and maintenance to items such as electronic equipment and suction apparatus; these repairs may be carried out in any workshop provided for in the operating department as indicated in Hospital Building Note No. 26. It should preferably lead off the 'outer' corridor to enable maintenance staff to service the equipment without the need to don protective clothing and overshoes. It should be fitted with a work bench with socket outlets for testing electronic equipment, shelves or cupboards for items waiting to be repaired and drawers for tools. An area of 100 square feet (9.5m^2) should suffice.

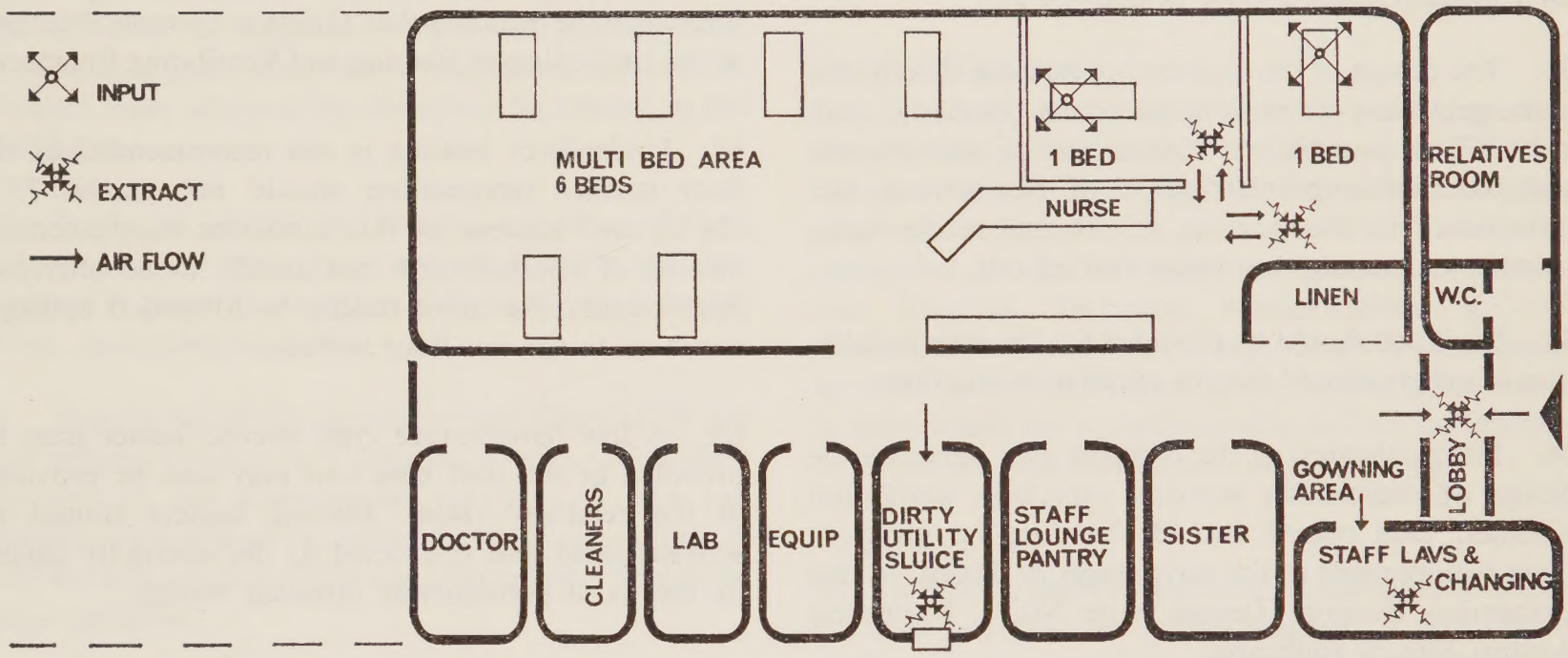


FIGURE 5. Air flow diagram. Layout as in Figure 2.

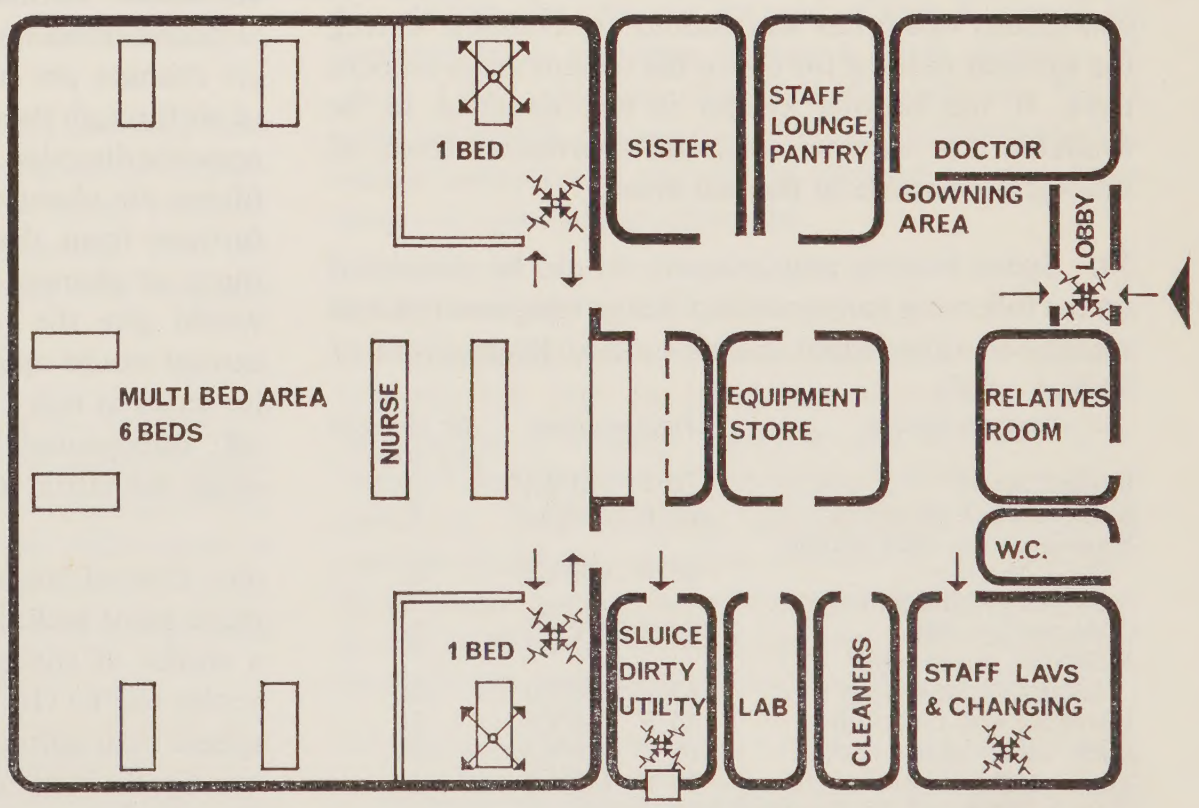


FIGURE 6. Air flow diagram. Layout as in Figure 3.

V. Engineering services

52. The therapy and procedures undertaken on patients in this unit will in most instances be entirely dependent upon the efficient and uninterrupted use of the medical machines and equipment upon which the life of the patient may depend. It will not be uncommon for several machines or items of equipment to be in use at the same time and in emergency situations additional items may need to be deployed without any delay. The engineering services to meet these demands should be designed to provide a liberal provision of service outlets and facilities to ensure that in the event of mains failure or interruption, vital machinery and equipment can continue to function or be brought into use immediately.

53. Where the unit is situated close to the operating theatre department the sharing of plant room and the extension of some of the engineering services, particularly medical gases, should be considered.

54. The design of the engineering services should also make provision for reasonable access (avoiding clean areas where possible) to ensure ease of maintenance and the minimum interruption of the services and disturbance to the working of the unit while maintenance and repairs are being carried out.

55. Facilities should be provided for the easy installation of meters should they be required at any time.

56. Fire protection of the building may influence the design of engineering services, especially ventilation schemes. Due regard should therefore be given to these requirements in the early stages of design. In this connection Hospital Design Note No. 2, Protection Against Fire, is applicable.

Mechanical services

Heating

57. The heating system should be designed for continuous operation and should be available during the summer months for use in the patient areas on cold days. If the heating system is not designed to be available for summer use, an alternative form of heating is desirable in the bed areas.

58. Space heating requirements should be calculated on the following recommended design temperatures and ventilation rates based on an outside temperature of 30°F. (—1°C).

Accommodation	*Temperature*	*Air changes per hour*
Patient areas	70°F* (21°C)*	3†
Staff base, clean utility	65°F (18°C)	2
Sister's room, staff lounge/ beverage bay	65°F (18°C)	2
Laboratory/clinical room, doctor's room	65°F (18°C)	2
Relatives' room, staff lavatory/cloakroom	65°F (18°C)	2
Entrance and circulation	65°F (18°C)	2
Dirty utility/sluice room	60°F (16°C)	5
Stores and cleaners' room	50°F (10°C)	½

(*) see paragraph 65 for single-bed rooms

(†) see paragraph 64, single-bed rooms should have fifteen air changes per hour.

59. A conventional hot water heating system with radiators provides a generally satisfactory form of heating and has comparatively low installation and maintenance costs. Flush-fitting radiators are to be preferred as these are cleaner than convectors which are difficult to keep clean; also the dust and fluff which tends to collect on the elements is a potential source of infection.

60. Radiators should be placed below windows and against exposed walls to counteract cold air currents. If ordinary radiators or convectors are used a clear space of 9 inches (230mm) should be left beneath them to facilitate floor cleaning by machines.

61. Where ceiling-heating systems are used they should conform to the recommendations of the Medical Research Council's Environmental Research Unit. These may be found in the "Guide to Current Practice" of the Institution of Heating and Ventilating Engineers.

62. Under-floor heating is not recommended as the floor surface temperature should not exceed 75°F (24°C) and because of this limitation supplementary heating of another form has usually to be provided. Also odours can more readily be formed if spillages occur on to the hot floor surface.

63. A low temperature type electric heater may be provided at the staff base and may also be provided in the relatives' room. Electric heaters should be wall-mounted and connected to the electricity supply by means of permanently installed wiring.

Ventilation

64. Basically the unit should be naturally ventilated but the single-bed rooms should be mechanically ventilated. To make a contribution to the control of airborne infection, a ventilation rate of about fifteen air changes per hour should provide a sufficient flow of air through the open doorway to prevent a flow in the opposite direction. Thus a system capable of introducing fifteen air changes per hour of fresh air at the end furthest from the door, and extracting at a rate of thirty air changes per hour at the end nearest the door, would give the required results. Fresh air inlet and extract would operate together for infectious cases, but for cases at risk of infection the extract would be shut off; background heating from the heating system to offset the fabric losses may be advantageous.

65. One of the single-bed rooms can have air treatment plant included in its ventilation system to allow a choice of environmental conditions ranging from a cooler (60°F) (16°C) to a warmer (80°F) (27°C) atmosphere than normal and also a moist or dry atmosphere; usually the higher humidity condition (85 per cent to 90 per cent relative humidity) will only require to be associated with the cooler atmosphere.

66. Internal lavatories should have mechanical extract ventilation to give ten air changes per hour. Mechanical extract discharging externally should be provided in the dirty utility/sluice room at low level and in the staff lavatory/cloakroom at high level.

67. If it is considered desirable to provide a small mechanically ventilated lobby/airlock at the entrance to the unit or adjacent to the post-operative recovery unit to reduce the ingress of air, the lobby/airlock for this purpose should be mechanically (extract) ventilated at a rate of ten air changes per hour.

68. The controls for the mechanical ventilation systems, apart from stop-start controls, should be so arranged and housed that only authorised persons have access to make the adjustments necessary to change the mode of ventilation or to vary the room conditions.

69. Visible indication should be provided to show when the ventilation systems are operating. The indicators for the single-bed rooms will probably best be positioned just outside these rooms and visible from the staff base; alternatively they may be located at the staff base.

70. Fresh air should be filtered, conditioned, and introduced into the room through suitable diffusers designed to avoid the creation of draughts; there should be no re-circulation of air.

71. Ventilation plants should include filters of 95 per cent efficiency down to 5 microns to give satisfactory filtration of the incoming air supplies; to save too frequent replacement of these where the air is dirty it may be desirable to include also coarse filters to remove larger particles.

72. External discharges should be carried clear of the building and protected against back pressure from the wind. Grilles should be installed, preferably in corridor walls, to provide an air inlet for rooms which rely solely on mechanical extract for their ventilation.

73. The noise level in the patient areas and staff base should not exceed the International Standards Organization Noise Rating of 35 when the sound pressure level is measured at any point in the rooms. That for the plant room should be in accordance with Hospital Design Note No. 4, Noise Control.

74. Particular care should be given to the type of opening window selected in naturally ventilated wards. Top opening windows at high level should be provided with a 'minimum setting' notch or other adjustment to allow air infiltration without draught to the lightly clad patients. In ceiling heated rooms the incoming air should not be directed at the ceiling.

Hot and cold water and drinking water services

75. These are normally provided by connection to the main services of the hospital.

76. Drinking water points will be required in the staff lounge/beverage bay, the w.c. *en suite* with the relatives' room, and near the medicine cupboard at the staff base; the points should be connected directly to the supply undertakings mains or to protected storage tanks supplying drinking water only.

77. Lever arm taps of the type having a mixed flow outlet will be required for staff hand-basins in patient areas and ancillary rooms where aseptic practices make this necessary. Lever arm taps should be provided in the clean utility and dirty utility/sluice rooms. Pillar taps should normally be provided elsewhere, but spray mixing taps have advantages for hand-basins *en suite* with w.c.'s, in that water consumption is reduced and the outlet temperature can be controlled.

78. The hot water circulation system should also serve heated bed-pan and linen cupboards, and where they are provided in the cloakroom, the coils for clothes drying.

Sterilizing equipment

79. A small, portable, electrically-heated pressure steam sterilizer 7 inches (175mm) diameter by 12 inches (300mm) long to draft B.S.3970, part 4 for emergency use, may be required in the clean utility area. This equipment should be regularly inspected and tested (see Hospital Technical Memorandum No. 13, Planned Preventive Maintenance). Consideration should be given to the use of distilled or demineralised water, in areas where tap water is not very soft, in the chamber or steam generator to ensure efficient usage.

**Oxygen*

80. A piped oxygen system with connections available for each bed position will be required; a flow rate at each connector of 20 litres per minute at a pressure of 50 to 60 pounds per square inch (3.5 to 4.0 bar) should be satisfactory.

81. Where the unit has its own system it should be supplied from cylinders having a total capacity of about 1,000 cubic feet ($30m^3$) divided into two banks with automatic change-over controls incorporating a visible indication in the unit to warn when one of the banks of cylinders is exhausted.

Medical vacuum

82. A piped system with two outlets available for each bed position will be required; each outlet should incorporate a vacuum restricter and shut-off valve. Vacuum gauges fitted to the vacuum bottles are to be preferred. Each vacuum service point should be capable of permitting a free air flow of not less than 40 litres per minute when the vacuum in the pipeline system is 500 millimetres of mercury below a standard atmospheric pressure of 760 millimetres of mercury.

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* Engineering Data sheets EE1.1 to 9.7 on oxygen, nitrous oxide, medical vacuum and medical compressed air have been issued to Regional Hospital Boards.

Compressed air

83. A compressed air system will not usually be required but one or two outlets may be provided where a nearby installation can be conveniently extended into the unit. Where, however, compressed air is provided which is intended to be used for breathing and is supplied by a compressor, great care should be taken to ensure that the air is filtered, dried and oil free before it enters the distributing system.

Nitrous oxide

84. The demand for nitrous oxide will not normally be sufficient to justify the installation of a piped system, except, as for compressed air, where advantage can be taken of a nearby system.

Steam supply

85. A steam supply to the dirty utility/sluice room may be required for bed-pan washer and/or bed-pan storage cabinets.

Town gas

86. A gas supply may be required for appliances in the staff lounge/beverage bay and laboratory. Where provided, gas appliances should be fitted with flame failure safety devices.

Electrical installation

General

87. The electrical installation will include wiring and equipment for general and special lighting, socket outlets, emergency electrical services, telephones, clocks, call systems, fire alarms, radio, and also wiring for the mechanical services and conduit or trunking for patient monitoring.

Supply and distribution

88. The electrical supply will normally be provided by a sub-main circuit from the main intake or local distribution centre. Distribution boards should be easily accessible from a standing position and housed in the switchgear room; high rupturing capacity (H.R.C.) fuses are recommended and, in addition to the provision of spare ways and fuses, space should be allowed for future additional units.

89. Conduits and cables should be concealed in wards and other public parts of the hospital. Service ducts should be used where practicable.

Lighting

90. The lighting of the patient areas should satisfy the conflicting needs of being adequate for close observation and treatment, without being too disturbing to the patient. A reasonable compromise would be to illuminate uniformly each bed area by lighting from the ceiling to a maximum of 30 lumens per square foot (300lux) at bed level with means of adjustment down to a very low level by individual dimming devices; the on/off switches may be situated centrally for the open bed area and by the doors of the single-bed rooms. Glare to the patient must be minimised by careful selection and arrangement of the lighting fittings and the colour characteristics of the lamps should be one of the types having recommended colour rendering properties for clinical applications.

91. Should a higher intensity than 30 lumens per square foot (300lux) be required, it can be provided by a portable type fitting complying with B.S.3541.

92. Lighting should also be provided at low level for sufficient illumination beneath the bed so that drainage bottles and under-bed seals can be checked. Separate night lighting should be provided in the circulation space of the bed areas. In other areas lighting should follow normal standards and modern practice.

93. Generally, lighting fittings should be readily accessible for maintenance and easy cleaning.

94. The avoidance of glare is important and a glare index of not more than 13 is recommended. All lights should be screened from the beds; mirrored reflections of lights in the bed areas should be avoided and lighting outside the bed area should not be visible from the bed through unscreened glazing. In this connection attention is drawn to the Medical Research Council and Building Research Board Joint Committee's Report No. 63/89, entitled "Recommendations for the artificial lighting of hospital wards and single-bedded rooms".

95. The following table gives recommended values of illumination for the various rooms, other than patient areas:

Accommodation	*Average lumens/square feet recommended at working level*
Staff base, sister's and doctor's rooms	15 (150 lux)
Laboratory	20 (200 lux)
Staff lounge/beverage bay, clean utility room, dirty utility/ sluice room and relatives' room	10 (100 lux)
Cleaners' room, lavatories and cloakrooms	7* (80 lux*)
Corridors and stores	7*† (80 lux*†)

(*) The standard given is required at floor level.
(†) This may be increased where adjacent intensities are high.

96. Tungsten lighting is generally suitable for fittings which will be used intermittently. Fluorescent lighting will generally be more economic where lighting is required for long periods.

97. The lighting of the staff base should be carefully designed for the needs of the staff but at the same time must not be disturbing to patients, particularly at night.

98. Lighting fittings in the staff lounge/beverage bay and relatives' room should be selected to give a pleasing effect. Lighting in ancillary rooms, for example laboratory and dirty utility/sluice room, should be arranged to give direct lighting over the working areas.

99. A red indicating light should be provided on the drug cupboard with a parallel indicating light in the sister's room. These lights should be interlocked with the cupboard to give visual indication when the cupboard is unlocked.

Socket outlets

100. Socket outlets for general use should be of the 13 amp. switched and shuttered type and connected to ring or spur circuits.

101. Eight socket outlets available for each bed should be adequate; it is recommended that these outlets are so sited as to enable equipment to be used on either side of the beds. All these socket outlets should also be connected to the essential electrical service and denoted to facilitate easy recognition in accordance with Hospital Technical Memorandum No. 11, Emergency Electrical Services.

102. Sufficient socket outlets should be provided to allow all portable appliances which are likely to be used at the same time to be supplied separately from convenient sockets.

103. The following socket outlet distribution is suggested:

Single and multi-bed areas	Eight single outlets per bed;
Staff lounge/beverage bay	To suit number of appliances, plus one or two for future requirements;
Laboratory	Four twin outlets;
Equipment store	Two twin outlets;
Staff base, sister's and doctor's rooms	One twin outlet;
Clean utility area	To suit number of portable appliances;
Relatives' room	Two outlets;
Dirty utility/sluice room	One single outlet.

104. Additional socket outlets approximately 30 feet (9m) apart should be provided as necessary throughout the unit, including corridors, to allow for the convenient use of domestic cleaning appliances having flexible leads 30 feet (9m) long.

105. Fixed appliances rated up to 13 amp. should be permanently connected to 13 amp. fused spur boxes. Appliances rated in excess of 13 amp. should be permanently connected to separate final sub-circuits and independently switched.

106. Indicating lights to show when the electrical supply is switched on should normally be incorporated in electro-medical apparatus or low temperature heating appliances (see Hospital Technical Memorandum No. 8, Safety Code for Electro-medical Apparatus). Where this is not provided on the appliance a plug incorporating a neon type lamp could be used.

Extra low voltage socket outlets

107. Extra low voltage socket outlets will not normally be required.

Mains voltage outlets for mobile x-ray apparatus

108. 13 amp. socket outlets and ring circuits are suitable for supplying all mobile x-ray apparatus. A special 13 amp. plug is available commercially, which has been designed to accommodate the larger sizes of flexible cables used with mobile x-ray apparatus. It is important, however, that the impedance of the mains up to the 13 amp. socket does not exceed the limit specified by the set manufacturer, otherwise excessive voltage drop may occur during exposures.

Typical maximum mains impedance requirements are as follows:

300 mA. sets	0.34 ohms
200 mA. sets	0.6 ohms
100 mA. sets	1.0 ohms

109. Tests have shown that standard distribution arrangements and 7/.029 inch ring circuits will enable impedance readings of less than 0.34 ohms to be obtained in some instances, but values may be in excess of 0.34 ohms where long sub-main or ring wiring is involved. With 240 volt mains and an impedance of 0.1 ohms at the distribution fuse-boards, all 13 amp. sockets will have an impedance less than 0.34 ohms where 7/.029 inch wiring is used and the length of the ring does not exceed 85 yards or 130 yards where 7/.036 inch wiring is used.

Positioning of socket outlets

110. Socket outlets in the nursing and general working areas at or about skirting height are often inconvenient and should preferably be placed at the working level or at about waist height; wherever practicable outlets should be flush-mounted.

Emergency electrical supplies

111. Guidance on the provision of emergency electrical supplies is given in Hospital Technical Memorandum No. 11, Emergency Electrical Services.

112. Emergency lighting grade (*a*) equal to or nearly equal to that under normal supply conditions should be provided for the bed areas, and grade (*b*) to about half the normal recommended standard should be provided at the staff base and in the areas of utility rooms to enable essential activities to be carried on. Skeleton emergency lighting grade (*c*) to a much reduced standard but sufficient to allow free movement may be required in other nursing areas not included above and in corridors, to allow movement with reasonable safety.

113. Battery operated lanterns should be provided for working areas which have no installed emergency lighting.

114. For each bed area socket outlets should be so distributed as to be connected to at least two separate sub-circuits.

Staff location system (See Hospital Technical Memorandum No. 20)

115. A staff location system should be provided as part of the general staff location system of the hospital.

Patient/nurse call system

116. A nurse call system will not be necessary but an emergency button should be provided at each bed-head to enable a nurse to call assistance, sounding an alarm audible throughout the unit. In single-bed rooms, it should also operate a light over the doors to indicate where the call has been initiated.

Telephones

117. Telephone facilities for internal and external calls for the ward unit will form part of the hospital telephone system, and will normally be provided in the doctor's room, sister's room, and at the staff base. Telephones should normally be desk pattern, and for sisters and nurses should be fitted with an indicating call light visible from the open bed area, and a bell of subdued tone which, when desired, may be switched out of circuit independent of the call light.

118. If the intensive therapy unit is not adjacent to the operating theatre department it is essential there should be a direct telephone line from the staff base to that department for use in an emergency.

119. A notice giving explicit directions to the nearest public telephone should be displayed in the relatives' room.

Electric clocks

120. Electric clocks will normally be required in the single-bed rooms and in the open-bedded area; the clock in the open-bedded area should also be visible from the staff base.

121. Clocks should have silent movements and sweep second-hands; 9 inch (230mm) diameter dials are generally suitable.

Patient monitoring equipment

122. At the present time patient monitoring is not widely employed. However its more general adoption should be anticipated and facilities by way of trunking and conduit should therefore be provided between the bed areas and the staff base.

123. The trunking should have ample capacity and should be compartmented so as to segregate mains wiring from communications wiring, designed to follow as direct a route as practicable, avoid sharp bends and be provided with adequate access to enable wiring to be drawn in easily.

Fire alarms and fire fighting equipment

124. Information on fire alarms and extinguishers is given in Hospital Technical Memorandum No. 16, Fire Precautions (revised 1969). Approval of the fire fighting installation proposed should be sought from the local fire authority.

Equipment

Sterilizing equipment

125. The supply of instruments, bowls etc., will normally be from a central sterile supply department. There is, therefore, no need to provide sterilizing facilities in the ward, but a small portable electrically-heated pressure steam sterilizer (to B.S.3970, part 4) may be required in the clean utility area for emergency use.

Bed-pan washers

126. A bed-pan washing and disinfecting machine should be provided in the sluice room. The disinfecting process entails maintaining the bed-pans at a temperature of 176°F (80°C) for one minute or other acceptable time/temperature combination. Any bed-pans which require to be sterilized should be sent to the central sterile supply department for this purpose after they have been washed and disinfected. If disposable bed-pans are to be used a bed-pan disposal machine will be required; the drainage connection from these machines must be of adequate size and be designed to ensure that the effluent is safely carried away to the sewer. If a drain connection to a bed-pan disposal machine is too big the solids may not be carried in suspension to the main sewers. Where disposable bed-pans are used and the bed-pan carrier requires sterilization, it should be sent to the central sterile supply department for this purpose.

Drug cupboard alarm

127. It is recommended that the drug cupboard in the clean utility area should be fitted with an approved type of burglar alarm system to give a suitable audible warning adjacent to the staff base in cases of unauthorised opening and/or possible theft.

Incinerators

128. A collecting system and disposal in a central incinerator is to be preferred to a local unit.

APPENDIX

Table of accommodation

	Type of room	*Suggested individual room size*	
		square feet	(m^2)
(i)	Patient area: single room/cubicle	200	(18.5m²)
	multi-bed area (per bed)	200*	(18.5m²)*
(ii)	Staff base	120–200*	(11m²–18.5m²)*
(iii)	Clean utility area		
(iv)	Sister's room	105	(10m²)
(v)	Staff lounge/beverage bay	140	(13m²)
(vi)	Equipment store	200	(18.5m²)
(vii)	Dirty utility/sluice room	140–180	(13m²–16.5m²)
(viii)	Laboratory	80	(7.5m²)
(ix)	Doctor's room/overnight stay	140	(13m²)
(x)	Store for linen trolleys (one or two cupboards each)	25	(2.5m²)
(xi)	Staff lavatory and cloakroom—lavatory:	100 square feet	(9.5m²) (shower, w.c., lavatory basin)
	—cloakroom:	8 square feet (0.75m²) per person on duty at any time	
(xii)	Gowning area and entrance to unit	50–100	(4.5m²–9.5m²)
(xiii)	Relatives' room plus lavatory accommodation	115 plus 25	(11m² plus 2.5m²)
(xiv)	Cleaners' room	50	(4.5m²)
(xv)	Switchgear room	40	(4m²)
(xvi)	Circulation space within the above area	—	

*The total area provided will depend on the circulation space in the layout adopted.

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11	Dining rooms	2s 0d (2s 4d)
12	Out-patient department	5s 0d (5s 6d)
14	Training school for nurses	3s 0d (3s 4d)
15	Pathology department	5s 0d (5s 6d)
16	Boiler house and steam boiler plant	1s 6d (1s 10d)
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